REMARKS

In view of the following discussion, the Applicant submits that none of the claims now pending in the application is anticipated under the provisions of 35 U.S.C. § 102 or made obvious under the provisions of 35 U.S.C. § 103. Thus, the Applicant believes that all of these claims are now in allowable form.

I. REJECTION OF CLAIMS 27, 29 AND 31 UNDER 35 U.S.C. § 112

The Examiner has rejected claims 27, 29 and 31 under 35 U.S.C. § 112 for allegedly failing to comply with the enablement requirement and for allegedly being indefinite. In response, the Applicant has amended claims 27, 29 and 31 in order to more clearly recite aspects of the present invention.

Specifically, claims 27, 29 and 31 have been amended to recite a state threshold that is "dynamically <u>adjustable</u>", replacing a state threshold that is "dynamically <u>adjusted</u>". The Applicant submits that a dynamically adjustable threshold for assessing a probability of a match between an element of a subgrammar and an input speech signal is described in the specification in a manner that is sufficiently enabling and definite (see, for example, paragraph [0027]: "A dynamically adjustable threshold may be used to determine the probability of a word match."). Accordingly, the Applicant respectfully requests that the rejection of claims 27, 29 and 31 under 35 U.S.C. § 112 be withdrawn.

II. REJECTION OF CLAIMS 1, 2 AND 8-35 UNDER 35 U.S.C. § 102

The Examiner has rejected claims 1, 2 and 8-35 in the Office Action as being anticipated by the Brown et al. patent (US patent 5,719,997, issued on February 17, 1998, hereinafter Brown). The Applicant respectfully traverses the rejection.

Brown teaches a speech recognition system that uses an evolutional grammar to recognize an input speech signal in real time. In particular, Brown teaches that as speech recognition processing begins, only a portion of a system grammar (*i.e.*, a vocabulary comprising a plurality of interrelated words) is implemented for recognition purposes. As more of the speech signal is received by the system and as processing

proceeds, additional portions of the grammar network (*i.e.*, additional words or vocabulary) are implemented as necessary. In other words, a single system grammar is assembled, piece-by-piece, as the speech signal is received.

The Examiner's attention is directed to the fact that Brown fails to disclose or suggest the novel invention of acquiring or applying both a top-level grammar and one or more related subgrammars (including, for example, a word subgrammar, a phone subgrammar and a state subgrammar), as claimed in Applicant's independent claims 1, 11, 18, 34 and 35. Specifically, Applicant's claims 1, 11, 18, 34 and 35 positively recite:

1. A method for allocating memory in a speech recognition system comprising the steps of:

acquiring a first set of data structures that contain a grammar, a word subgrammar, a phone subgrammar and a state subgrammar, each of the subgrammars related to the grammar;

acquiring a speech signal;

performing a probabilistic search using the speech signal as an input, and using the grammar and the subgrammars as possible inputs; and

allocating memory for one of the subgrammars when a transition to that subgrammar is made during the probabilistic search. (Emphasis added)

11. In a speech recognition system, a method for recognizing speech comprising the steps of:

acquiring a first set of data structures that contain a grammar, a word subgrammar, a phone subgrammar and a state subgrammar, each of the subgrammars related to the grammar;

acquiring a speech signal;

performing a probabilistic search using the speech signal as an input, and using the grammar and the subgrammars as possible inputs;

allocating memory for one of the subgrammars when a transition to that subgrammar is made during the probabilistic search; and

computing a probability of a match between the speech signal and an element of the subgrammar for which memory has been allocated. (Emphasis added)

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18. In a speech recognition system, a method for recognizing speech comprising the steps of:

acquiring <u>a first set of data structures that contain a top level grammar and a plurality subgrammars</u>, each of the subgrammars hierarchically related to the grammar and to each other;

acquiring a speech signal;

performing a probabilistic search using the speech signal as an input, and using the top level grammar and the subgrammars as possible inputs;

allocating memory <u>for specific subgrammars</u> when transitions to those specific subgrammars are made during the probabilistic search; and

computing probabilities of matches between the speech signal and elements of the subgrammars for which memory has been allocated. (Emphasis added)

34. A method for allocating memory in a speech recognition system comprising the steps of:

acquiring <u>a set of data structures that contain a grammar and one or more subgrammars related to the grammar</u>;

acquiring a speech signal;

performing a probabilistic search using the speech signal as an input, and using the grammar and the subgrammars as possible inputs; and

allocating memory <u>for a selected one or more of the subgrammars</u> when a transition to the selected subgrammar is made during the probabilistic search. (Emphasis added)

35. In a speech recognition system, a method for recognizing speech comprising the steps of:

(a) acquiring <u>a set of data structures that contain a grammar and one or more subgrammars related to the grammar</u>;

(b) receiving spoken input;

(c) using one or more of the data structures to recognize the spoken input;

(d) while the speech recognition system is operating, acquiring a second set of data structures that contain a second grammar and one or more subgrammars related to the second grammar; and

(e) repeating steps (b) and (c), using the second set of data structures in step (c). (Emphasis added)

Applicant's invention is directed to a method for allocating memory in a speech recognition system. Conventional speech recognition systems require a great deal of memory in order to accommodate and process large vocabularies. These systems typically compile, expand, flatten and optimize all grammars contained in a system

vocabulary into a large, single-level data structure that must be stored in memory before the speech recognition system can operate. Such techniques substantially restrict the capabilities of speech recognition systems that operate on limited memory and processing power, such as portable speech recognition systems.

The present invention provides a method for speech recognition in which memory is allocated to a particular system subgrammar when a transition is made to that subgrammar during a probabilistic search. A system vocabulary has a hierarchical data structure including at least one top-level grammar (*e.g.*, "Days of the Week") and at least one subgrammar within that top-level grammar such as a word subgrammar (*e.g.*, Monday, Tuesday, Wednesday, etc.), a phone subgrammar (*e.g.*, /m/, /ah/, /n/, /d/, /ey/, etc.) and a state subgrammar (*e.g.*, comprising Hidden Markov Models). When the system receives a speech signal for processing, the speech signal is input, along with the (unexpanded) top-level grammar and one or more subgrammars, into a probabilistic search. When a transition is made to a particular subgrammar during the probabilistic search, memory is allocated to the subgrammar, which may then be expanded and evaluated to assess the probability of a match between the speech signal and an element in the subgrammar. In this manner, memory is conserved and allocated only to portions of the system vocabulary that are currently needed for speech processing.

In contrast, Brown teaches a method in which successive portions of a <u>single grammar</u> are implemented piece-by-piece, *e.g.*, as more of the incoming speech signal is received. Thus, Brown fails to anticipate or make obvious Applicant's invention.

Specifically, Brown only teaches that <u>common-level</u> portions of a grammar are gradually implemented. For example, after a first word in the speech signal is recognized using a first portion of the grammar, a new portion of the grammar is implemented that includes words that could potentially follow the recognized word in a valid command. Brown does not teach that the grammar has a <u>hierarchical data structure</u>, *e.g.*, including not only a <u>top-level grammar</u> and <u>word subgrammar</u>, but corresponding <u>phone and state grammars</u> as well. Nor does Brown teach that system memory may be allocated <u>to a subgrammar</u> of a hierarchical data structure.

The Examiner alleges that a grammar, a word subgrammar, a phone

subgrammar and a state subgrammar, while not explicitly taught by Brown, are inherently acquired by the method taught by Brown. The Applicant respectfully disagrees. "To establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by person of ordinary skill.'" In re Robertson, Slip Op 98-1270 (Fed. Cir. February 25, 1999) citing Continental Can Co. v. Monsanto Co., 948 F.3d 1264, 1268, 20 USPQ2d 1746, 1749 (Fed Cir. 1991) (Emphasis added). "Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result for a give set of circumstances is not sufficient." Id. citing Continental Can Co. v. Monsanto Co., 948 F.3d 1264, 1269, 20 USPQ2d 1746, 1749 (Fed. Cir. 1991) (Emphasis added).

Brown makes no mention of implementing data structures that descend as far as the sub-word (*e.g.*, phone or state) level, much less of allocating memory for such levels of a data structure. At most, Brown teaches recognition at the word level. Thus, a data structure that includes a grammar, a word subgrammar, a phone subgrammar and a state subgrammar is not necessarily acquired by the method taught by Brown, and acquisition of such a data structure cannot be inherently present in Brown's teachings. Brown thus fails to teach or make obvious a method of allocating speech recognition system memory that acquires a top-level grammar and a plurality of subgrammars (including at least a word subgrammar, a phone subgrammar and a state subgrammar) and allocates memory to expand a subgrammar to which a transition is made, as positively claimed by the Applicant in claims 1, 11, 18, 34 and 35. Therefore, the Applicant submits that independent claims 1, 11, 18, 34 and 35 fully satisfy the requirements of 35 U.S.C. §102 and are patentable thereunder.

Dependent claims 2, 8-10, 12-17 and 19-33 depend from claims 1, 11 and 18 and recite additional features therefore. As such, and for at least the same reasons set forth above, the Applicant submits that claims 2, 8-10, 12-17 and 19-33 are not anticipated by the teachings of Brown. Therefore, the Applicant submits that dependent claims 2, 8-10, 12-17 and 19-33 also fully satisfy the requirements of 35 U.S.C. §102 and are patentable thereunder.

III. REJECTION OF CLAIMS 3-7 and 36 UNDER 35 U.S.C. § 103

The Examiner rejected claims 3-7 and 36 under 35 U.S.C. §103(a) as being unpatentable over Brown in view the Ehsani et al. application (U.S. Publication No. 2002/0032564, published March 14, 2002, hereinafter Ehsani). The Applicant respectfully traverses the rejection.

Brown has been discussed above. Ehsani teaches a method for creating grammar networks for use in natural language voice user interfaces (NLVUIs). Valid phrases are extracted from a text corpus and clustered into classes to create a "thesaurus" of fixed word combinations that represent different ways of saying the same thing. In this way, anticipated user responses can be expanded into alternative linguistic variants.

The Examiner's attention is directed to the fact that Brown and Ehsani (either singly or in any permissible combination) fail to disclose or suggest the novel invention of acquiring or applying both a top-level grammar and one or more related subgrammars (including, for example, a word subgrammar, a phone subgrammar and a state subgrammar), as claimed in Applicant's independent claim 1, from which claims 3-7 depend, and independent claim 36. Independent claim 1 has been recited above. Applicant's independent claim 36 positively recites:

36. In a speech recognition system, a method for recognizing speech comprising the steps of:

(a) acquiring from a first remote computer a set of data structures that contain <u>a grammar and one or more subgrammars</u> related to the grammar;

(b) receiving spoken input;

(c) using one or more of the data structures to recognize the spoken input;

(d) while the speech recognition system is operating, acquiring a second set of data structures from the first remote computer or from a second remote computer, the second set of data structures containing <u>a second grammar and one or more subgrammars</u> related to the second grammar; and

(e) repeating steps (b) and (c), using the second set of data structures in step (c). (Emphasis added)

As recited in the preceding claim, Applicant's invention teaches a method for speech recognition in which memory is allocated to a particular system subgrammar

(*e.g.*, a word, phone or state subgrammar) when a transition is made to that subgrammar during a probabilistic search. Memory allocation allows the subgrammar to be expanded and evaluated to assess the probability of a match between an input speech signal and an element in the subgrammar. In this manner, memory is conserved and allocated only to portions of the system vocabulary that are currently needed for speech processing.

In contrast, neither Brown nor Ehsani teaches or suggests this novel approach. Neither Brown nor Ehasni teaches acquiring a hierarchical data structure including a top-level grammar and at least one subgrammar (*e.g.*, including sub-word structures such as phone or state subgrammars) for the purposes of memory-efficient speech recognition processing, as positively claimed by the Applicant in claims 1 and 36. Therefore, the Applicant submits that independent claims 1 and 36 fully satisfy the requirements of 35 U.S.C. §103 and are patentable thereunder.

Dependent claims 3-7 depend, either directly or indirectly, from claim 1 and recite additional features thereof. As such and for at least the same reasons set forth above, the Applicant submits that claims 3-7 are also not made obvious by the teachings of Brown in view of Ehsani. Therefore, the Applicant submits that dependent claims 3-7 also fully satisfy the requirements of 35 U.S.C. § 103 and are patentable thereunder.

IV. CONCLUSION

Thus, the Applicant submits that all of the presented claims now fully satisfy the requirements of 35 U.S.C. §102 and §103. Consequently, the Applicant believes that all of these claims are presently in condition for allowance. Accordingly, both reconsideration of this application and its swift passage to issue are earnestly solicited.

If, however, the Examiner believes that there are any unresolved issues requiring the issuance of a final action in any of the claims now pending in the application, it is requested that the Examiner telephone Mr. Kin-Wah Tong, Esq. at (732) 530-9404 so that appropriate arrangements can be made for resolving such issues as expeditiously as possible.

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